**Nature vs. Nurture: Mysteries of Individuality Unraveled**

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Is it just coincidence that Bobby Bonds and his son Barry both made baseball history with their all-star power and speed? Or that Francis Ford Coppola and daughter Sofia rose to fame as award-winning film directors?

Questions like these have long plagued psychologists, geneticists and philosophers.

Coined [nature versus nurture](http://www.livescience.com/animalworld/ap_060525_cloned_mules.html), it is one of the [great mysteries of the mind](http://www.livescience.com/humanbiology/top10_mysteriesofthemind.html), and much research has focused on the relative role of [genes](http://www.livescience.com/humanbiology/060529_mm_genes.html) and the environment in determining everything from athleticism to personality to a person's predisposition to [obesity](http://www.livescience.com/humanbiology/060130_obesity.html).

**Smart research**

More than a century ago, [Sir Francis Galton](http://www.livescience.com/technology/050315_xray_prints.html) began studying the role of genes in [intelligence](http://www.livescience.com/humanbiology/060220_fish_brain.html). He theorized that parents transferred intelligence to their children, who in turn passed these intelligent-boosting genes down to their offspring.

To test his ideas, Galton used a method that’s still widely used today: twin studies.

In addition to looking alike, identical [twins](http://www.livescience.com/humanbiology/060520_births_hormone.html) carry exactly the same genes. By examining, for instance, differences between identical twins and fraternal twins, who grow up in the same environment but have different genetics, scientists can tease out environmental versus genetic affects.

With the advent of molecular genetics, and then in 2000 the mapping of the [human genome](http://www.livescience.com/animalworld/060517_hybrid_ancestors.html), scientists have been able to peer into the seemingly intangible blueprint within every cell of the [human body](http://www.livescience.com/php/trivia/index.php?quiz=bodyquiz3). Now, investigators are trying to find specific genes that could be responsible for certain behaviors such as [addiction](http://www.livescience.com/humanbiology/060517_women_addiction.html), athletic ability, [depression](http://www.livescience.com/humanbiology/060712_depressing_thoughts.html), and [violent tendencies](http://www.livescience.com/humanbiology/060320_genetic_aggression.html).

**Where Nature rules**

Researchers are identifying specific genes linked with behaviors and diseases. Some recent findings:

* Different versions of the gene CYP2A6 dictate the number of cigarettes a person [**smokes**](http://www.livescience.com/humanbiology/041129_smoking_feel.html). Those with one version of the gene metabolize nicotine, and thus, need to light up more often.
* Some 80 percent of a person’s risk of developing Alzheimer’s disease is genetic.
* Sprinters are more likely than endurance runners to display a certain gene variant that is thought to cause the skeletal muscles to contract more powerfully at high speeds.
* The genetic influence to [**alcoholism**](http://www.livescience.com/humanbiology/060331_loneliness.html) has been studied since the 1970s, when twin studies first revealed this link. In April of this year, a team led by Susan Bergeson at the University of Texas at Austin found 20 gene candidates that could influence excessive drinking.

“There are now four genes that have been shown by multiple research groups to contribute to risk of alcoholism,” according to Henry Kranzler, a professor of psychiatry at the University of Connecticut School of Medicine. And Kranzler expects they will find more. “This is a rapidly developing field, such that I would anticipate that up to another 10 such genes will be identified, with the findings replicated independently, in the next decade,” Kranzler told *LiveScience*.

**Middle ground**

This leap forward in the science of studying a person’s genes, however, hasn’t meant a slam-dunk for the nature camp. Rather, scientists are finding more and more evidence to support both sides of the input issue, and even results that buttress a view somewhere in the middle.

Last month, researchers at the University of Southern California found that when it comes to taking that first smoke, women are more likely than men to be affected by environmental factors such as peer pressure. Genetic factors, however, play a larger role in influencing men to start smoking.

Mayo Clinic researchers found that environmental factors, such as exposure to pesticides and industrial chemicals, play a greater role in men developing [Parkinson’s disease](http://www.livescience.com/humanbiology/ap_051213_mice_brain.html), while genetic factors affect Parkinson’s susceptibility in women.

And even though scientists are finding genes linked to alcoholism, they aren’t ruling out environmental factors.

“It is now widely accepted that genetic variation predisposes to alcohol and drug dependence, but it's also very clear that without environmental factors—including access to alcohol and drugs—addictions don't occur,” Kranzler said.

**Double trouble**

Muddling the whole debate is the finding that gene expression is influenced by the environment.

Turns out genes have what are called [epigenetic](http://www.livescience.com/humanbiology/050708_identical_twins.html) markers. Acting like a volume knob for genes, these tags adjust the intensity of gene expression. Identical twins are born with the same epigenome. But over time, environmental factors such as chemical exposure, diet and other lifestyle differences can alter these markers.

That’s why identical twins might become less alike as they get older. In one twin, an epigenetic marker could activate the gene expression for [schizophrenia](http://www.livescience.com/humanbiology/050907_schizotype_creative.html) or [cancer](http://www.livescience.com/humanbiology/cancer_killer_050120.html), but not in the other twin.

This discovery has added another layer of complexity to the nature-versus-nurture matter: For instance, finding that identical twins don’t both display a disorder such as addiction, doesn’t mean that addiction is not genetic.

Currently, researchers are embarking on the companion to the Human Genome Project—the Human Epigenome Project.

As usual, rather than illuminating a clear-cut answer to the nature-nurture debate, science is finding more questions. But one conclusion has emerged that might serve as the needed motivation to get even the least likely athletes off the couch:

“Genetic predisposition is not destiny,” Kranzler said.